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LACIE-00613
JSC-10828

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE)

NASA NOAA USDA

LACIE INTEGRATED DROUGHT PLAN

National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

May, 1976

LARGE AREA CROP INVENTORY EXPERIMENT

INTEGRATED DROUGHT PLAN

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April 30, 1976

CONTENTS

ACRONYMS

AES	Applications Evaluation System
AI	Analyst interpreter
ASATS	Automatic Statusing and Tracking System
C&I	Composition and indexing
CAMS	Classification and Mensuration Subsystem
CAS	Crop Assessment Subsystem
CCEA	Center for Climatic and Environmental Assessment
CMR	CAS monthly (crop) report
CRD	Crop reporting district
CUR	CAS unscheduled report
DPA	Data processing analyst
GSFC	Goddard Space Flight Center
ICD	Interface control document
ID	Identification
IE	Information evaluation
ISRRS	Information Storage, Retrieval, and Reformatting Subsystem
JSC	Lyndon B. Johnson Space Center
KSU	Kansas State University
LACIE	Large Area Crop Inventory Experiment
LARS	Laboratory for Applications of Remote Sensing
LPDL	LACIE Physical Data Library
NOAA	National Oceanic and Atmospheric Administration
PFC	Production film converter

USDA	United States Department of Agriculture
WMO	World Meteorological Organization
YES	Yield Estimation Subsystem

1. INTRODUCTION

The development and intensification of the drought in the United States southern Great Plains was monitored during the initial growing period (biowindow 1, i.e., between emergence and jointing) of the 1975-76 winter wheat crop. Due to the severity of the drought conditions, significant changes are expected to be observed in Landsat scenes obtained during biowindow 1 and subsequent acquisitions obtained in later biowindows. Normally, a significant change would not be expected in this imagery (in the southern Great Plains), although better classification results would be expected from the analysis of a temporal data set. The decision was therefore made to monitor the drought area in detail during the subsequent growth stages.

A drought analysis plan was developed by the Large Area Crop Inventory Experiment (LACIE) Episodal Events Team and presented to the LACIE manager on March 1. This plan outlined the area to be monitored: a portion of five of the southern Great Plains states which includes about one-half of the Great Plains winter wheat sample segments. The technical approach proposed the use of LACIE sample segments (5 x 6 n. mi.) and full frame imagery (100 x 100 n. mi.) on 9-day intervals to identify the drought area and quantify the effects on the wheat acreage. Yield model simulations would be run to extrapolate the effects of the drought on yield estimates at harvest, assuming 10, 50, and 90 percent of normal rainfall for subsequent months. Special aggregation would be performed by Crop Assessment System (CAS) on the drought area in order to evaluate the utility of remote sensing to monitor the effect of the drought on wheat area, yield, and production.

The implementability of the drought analysis plan was evaluated by the Application Evaluation Subsystem (AES). The evaluation showed that the use of Landsat 1 along with the planned use of Landsat 2 was feasible, although the acquisition and processing of this data would require some additional resources and procedures, as would the generation of drought specific yield and production estimates. However, the implementation of the drought analysis plan could be accomplished within the planned LACIE Phase II operations, and the processing of the additional data load during the months of March, April,

and May would not significantly impact the planned Phase II operations. The impact assessment was presented to LACIE management on March 5, and approval of the analysis plan and its proposed implementation was received.

The implementation of the plan began on March 8. Landsat 1 coverage of LACIE segments in the drought study area and full frame imagery for each Landsat pass was ordered retroactive to March 1. The drought specific acreage and yield estimates will be used in special drought reports to be generated by CAS in mid-April, May, and June, with the final evaluation report on the drought study available in July. The following presents the analysis plan for the drought study and the details of the specific activities to be performed by the LACIE AES in support of this plan.

1.1 OBJECTIVES

The objectives of monitoring the drought episodal event are to determine the extent of the present drought in the southern Great Plains area and to determine the effects of this drought upon acreage yield and production of wheat. This study will monitor the drought area for approximately three months. Procedures will be developed that may be useful in other areas for monitoring a drought phenomenon using remote sensing techniques.

1.2 DEFINITION

Drought is a period of time when precipitation drops far enough below the normal amount to cause a serious hydrologic imbalance in the affected area. The effects vary from slight reductions in size, vigor, and yield to outright killing of the plants. Low rainfall is not the only factor involved in drought. for climatic dryness is invariably associated with higher temperatures and wind which cause plants to use up soil moisture more rapidly. For this study, the initial drought area is assumed to be located within the 50 percent or less of normal precipitation isoline for the period December, 1975 to February, 1976 (fig. 1). However, weather conditions from the previous harvest will be evaluated. Approximate area is shown in figure 2. Area as defined will be held static unless flags from Yield Estimation Subsystem (YES) indicate need to expand area of study.

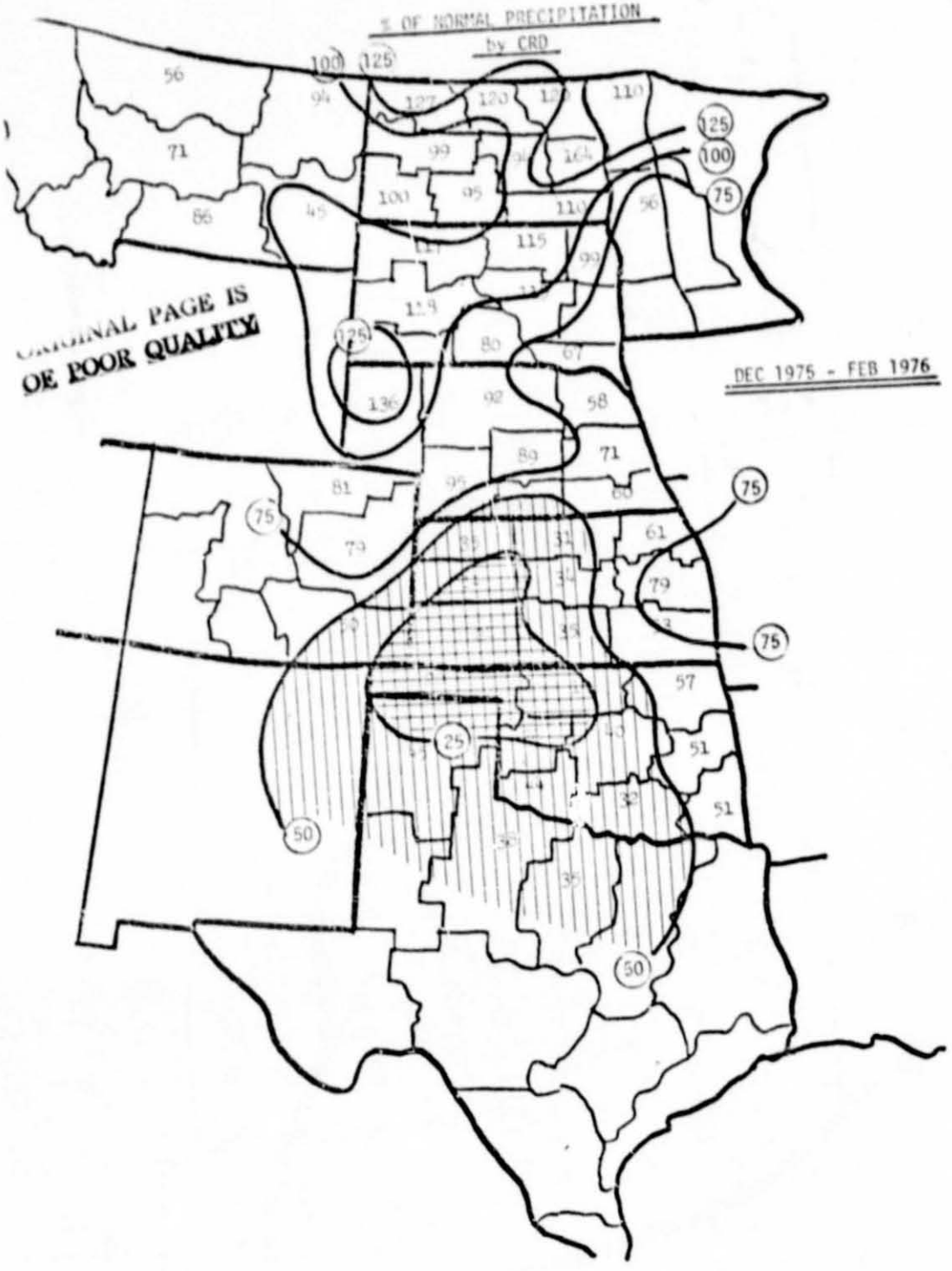

Figure 1. – Percentage of normal precipitation from December, 1975 to February, 1976.

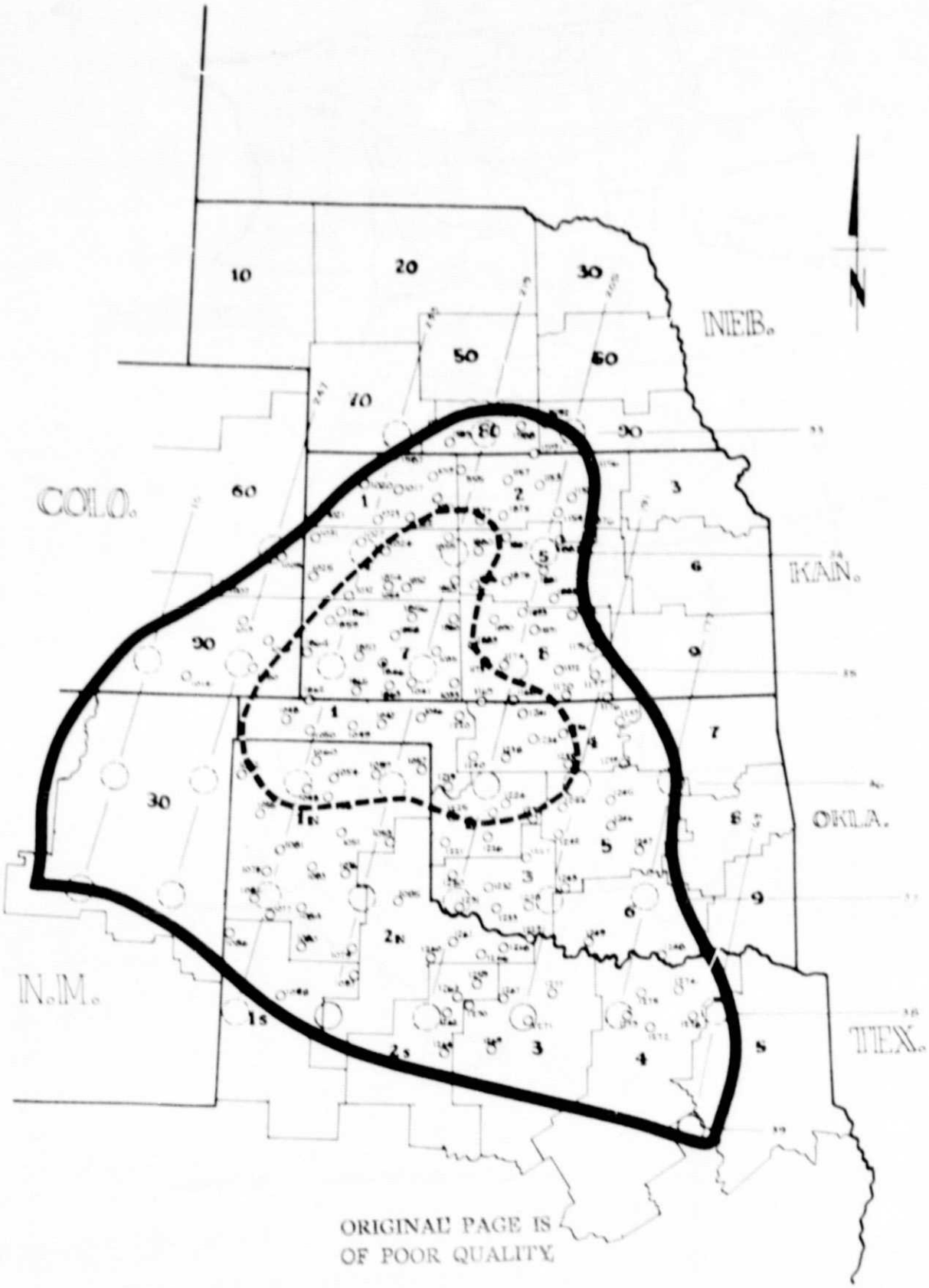

Figure 2. — Approximate initial [illegible]ht area.

2. CRITERIA FOR TERMINATION OF DROUGHT

The following approach will be utilized in evaluating the drought hazard over the area and in determining when the drought has ended:

1. YES will monitor daily precipitation, maximum-minimum temperature, and weekly precipitation by weather station. Area maps will be developed showing general location and amount of precipitation.

2. Areas located by YES will be monitored on full frame Landsat color infrared (IR) and sample segments for precipitation effect. The success of locating this areal extent of meteorological conditions will vary depending upon acquisition of Landsat data relative to precipitation.

3. The crop moisture index published in the Weekly Weather and Crop Bulletins from April to October will provide an overview of the weekly crop moisture situation. This index is responsive to weekly or current rainfall or the lack of it. The crop moisture index will be utilized to signal the end of the drought. When the index reaches 0 to 1.0 (moisture adequate for present needs) or greater than, the index will be monitored for two additional weeks. If the index remains at 0 to 1.0 or greater than 1 during this time, the drought will be considered as ending.

2.1 TECHNICAL APPROACH

An approach to monitoring the current drought situation involves monitoring present conditions by observing full frame (1:,1,000,000 scale) color infrared Landsat transparencies and sample segments on production film converter (PFC) film, and comparing these observations to like observations of normal crop years. This effort would be conducted through normal LACIE operations. The tasks necessary to accomplish this effort are:

1. Current crop year and past crop year full frame color infrared Landsat transparencies will be evaluated to determine the extent of the drought area. Meteorological data will be used to locate initially the extent of the area, and then Landsat transparencies will be used to refine the outlined area.

2. The extent of the drought area at fall planting time will be outlined on an overlay of the full frame imagery. Areal extent will be evaluated monthly until present, at which time it will be evaluated every 9 days.

3. Sample segments occurring within the drought area at fall planting time will be identified and modified as area enlarges or decreases.

4. Each sample segment acquisition will be examined and compared to previous years' acquisitions. Current year sample segments will be analyzed every 9 days to determine significant change (2 percent) and any acreage disappearance. Complete processing will be conducted only on segments having a significant change.

5. Overlays will be developed at 1:1,000,000 for the drought area showing planting dates, percent emergence, and weather conditions (precipitation and temperatures). They will be used to aid in locations of changing conditions in the drought area. Weather conditions will be monitored continuously during the effort.

6. Full frame imagery will be evaluated every 9 days using meteorological data to monitor any changes in the situation. Overlays from item 5 will be used to locate general areas of rainfall. A more exacting areal extent of meteorological conditions will be determined from the color infrared imagery. The meteorological effects at the crop reporting district (CRD) level will be determined.

7. Yield model simulations will be run and evaluated for the effect of the drought at the CRD level. Results obtained using alternates to the operational models should be compared to the operational products.

2.2 DATA REQUIREMENTS IN SUPPORT OF OBJECTIVES

The data requirements specified in this section are considered optimum to meet the stated objectives. Nonavailability of certain data sets will impact anticipated results. These impacts will be identified in a subsequent section. (See table I.)

1. Full frame (1:1,000,000) color infrared transparencies for current and past crop year (same biowindow). Current year data at 1:1,000,000 must be in-house within two weeks of acquisition.

TABLE I. – RESOURCE REQUIREMENTS (ESTIMATED)

Overall Coordination:			- 12 mw
Task 1	:	1 Coordinator (AI)	- 1 mw
		2 AI's	- 1 mw
Task 2	:	DAPTS	- 1 md
Task 3	:	YES	- 12 mw
		FSO	- 12 mw
Task 4, 5:		1 Coordinator (AI)	- 8 mw
		2 AI's	- 10 mw
Task 6	:	1 Coordinator (AI)	- 3 mw
		CAMS	- Daily operations
Task 7	:	NOAA	- As needed
Task 8	:	CAS	- As needed
Task 9	:	Coordinator	- 1 mw

2. All full frame imagery is required with less than 70 percent cloud cover.

3. Sample segment imagery in PFC film format for current and past crop years.

4. Nine-day Landsat coverage for current crop year (full frame and sample segments).

5. List of aggregated segments for current and past crop years.

6. Meteorological data (daily precipitation, temperature, and wind velocity [at land surface]).

7. Planting dates based on ground truth.

8. Intensive test site and blind site data.

2.3 IMPACT OF NONAVAILABILITY OF DATA

Certain problems are anticipated if the requested data are not available. They are as follows:

1. Lack of current full frame color infrared transparencies will affect the ability to determine the change in spectral signature associated with the effect of drought. The success of the effort would be greatly reduced if anything other than color infrared transparencies were used.

2. Without 9-day Landsat coverage, it would be difficult to monitor micro-climatic changes.

3. Daily precipitations, temperature, and wind velocity data will enable local environmental effects to be monitored.

4. Lack of planting dates will affect the ability to associate wheat's capability to withstand drought.

5. Current data must be available if a real-time effort is to be conducted.

2.4 PRODUCT DEFINITIONS

1. Maps showing initial areal extent of drought will be developed. This will be updated every Landsat acquisition.

2. Tabular data will be prepared showing changes taking place on the sample segments and if conditions seen on segments represent conditions observed on current full frame imagery. Disappearing fields will be documented on PFC film of sample segments.

3. Yield model simulations will provide yield estimates for different sets of assumed meteorological conditions; yield models run with current data (whenever possible, e.g., monthly) will give a CRD estimate of the drought impact on expected yields.

4. Output from tasks 2 and 3 will be used to aggregate area yield and production at the CRD level. The CRD estimates will be aggregated over the CRD's encompassing the drought region. Aggregation will be made with and without Landsat 1 data, with and without drought specific yields, for the drought area and for the Great Plains.

5. Ground truth intensive test sites and blind sites will be compared with results obtained from items 1 and 2.

6. Weekly bulletins and final report.

3. OPERATIONS IMPACT OF DROUGHT ANALYSIS PLAN

The Drought Analysis plan was evaluated by the AES from March 1 through 5, culminating in a presentation to LACIE management of the potential impacts. All components of LACIE were affected by the plan. Changes to existing procedures would be required and expenditure of additional resources would be necessary. Excess resources are not available in LACIE so resources had to be diverted from other tasks to support this effort. In general, the impact of the drought study could be accommodated within the LACIE Phase II operations.

The requirement for some additional support was identified by the Episodal Team and potentially by CAS, with the only other constraint identified being the possibility of some extra backlog in the Classification and Mensuration Subsystem (CAMS). There is a difficulty in quantifying the amount of CAMS analyst time required to process the Landsat 1 acquisitions, since it is not known how dynamic the situation being monitored will be. It is estimated that at best the processing of Landsat 1 data can be accommodated within the capacity of the system during the months of March, April and May. The worst case situation would be some backlog encountered during May that would result in delays in processing some of the U.S.S.R. winter wheat acquisitions. This should not impact the completion of Phase II as currently scheduled, assuming the drought plan is terminated as shown on the accompanying schedule (fig. 3). The expected increase in the segment workload of CAMS and the additional data subsequently transmitted to CAS are shown in the attached Phase II Landsat Data Acquisition and Processing chart (fig. 4). If the drought area monitored by Landsat 1 were increased or if planned acquisitions extended into June, the scope of Phase II could be impacted.

3.1 DAPTS SUPPORT FOR DROUGHT ANALYSIS

3.1.1 FULL FRAME IMAGERY

Goddard Space Flight Center (GSFC) will produce full frame, 9 x 9 inch, color infrared transparencies of all Landsat 1 and Landsat 2 frames over the designated drought area. Two copies of each acquisition over the nominal

	March	April	May	June	July
1. Inventory in-house 1:1,000,000 imagery (current and past crop year).	1 5 ▽ ▽				
2. Order needed 1:1,000,000 imagery.	9 ▽				
3. Assemble data and overlays.	1 ▽		25 ▽		
4. Determine areal extent of drought area.		13 20 ▽ ▽			
5. Monitor areal extent of drought area.		13 ▽		11 ▽	
6. Monitor sample segments.	16 ▽		25 ▽		
7. Run yield models (on data available).		6 ▽	6 ▽	7 ▽	
8. Aggregate area (on data available).		22 ▽	21 ▽	As required	
9. Prepare final report (weekly bulletins).					2 ▽ draft 30 ▽

Figure 3. — Schedule

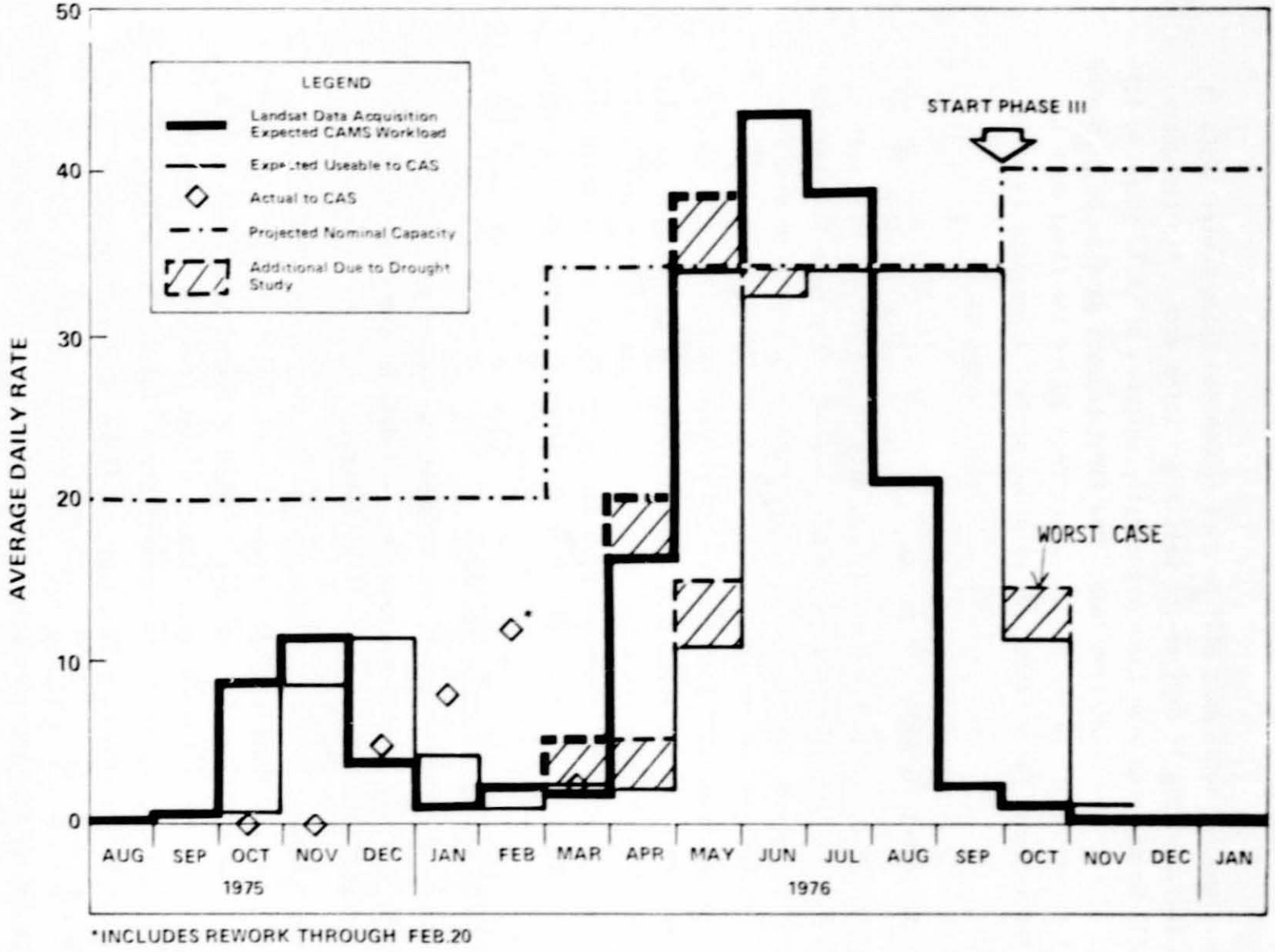

Figure 4. – Phase II data acquisition and processing.

frame locations (33 locations) will be sent to Johnson Space Center (JSC) in order to arrive within 14 days of the data acquisition date. The transparencies will be enclosed with the current daily shipment of LACIE tapes to take advantage of that transportation loop. The first Landsat pass to be processed into full frame imagery is the one which occurred during the first week in March. Requirements for a retrospective order of full frame data is being evaluated.

3.1.2 LACIE SAMPLE SEGMENTS

Digital data for the LACIE 5 x 6 n. mi. segments in the drought area (151 segments) will be processed through the GSFC system in the normal manner and supplied to JSC on the GSFC to JSC interface tape. The change in this procedure due to the drought situation is that Landsat 1 data will also be processed through the LACIE preprocessor and shipped in digital form to JSC. The Landsat 1 data will be shipped on separate tapes, which will be specially marked. The first Landsat 1 digital data to be processed will be from the aforementioned pass over the drought area during the first week in March, 1976. This data should begin to arrive at JSC in the March 25 through 28 time frame.

3.2 ISRRS SUPPORT FOR DROUGHT ANALYSIS

The Information Storage Retrieval, and Reformatting Subsystem (ISRRS) plan to provide data handling, status and tracking, and data base monitoring support for U.S. Great Plains drought study is as follows:

1. Provide a flag in Automatic Statusing and Tracking System (ASATS) to identify Landsat 1 and Landsat 2 acquisitions; initial identification of Landsat 1 acquisitions will be made by LACIE Physical Data Library (LPDL) personnel utilizing the JSC tape inventory list from GSFC. The first digit of the 9-character scene identification (ID) will be inspected. All scene ID's beginning with a 1 or 5 will be imagery acquired by Landsat 1.

   Responding to this identification, LPDL personnel will code the ASATS "B" card, which established the segment acquisition record in ASATS, to reflect the GSFC tape number preceded by the letter "B". The Landsat 1

imagery will arrive on the standard GSFC image tape which carries a number preceded by the letter "A". Therefore, a conscious effort will have to be made to identify Landsat 1 acquisitions with this special letter designation. Special reports from the ASATS can then be generated utilizing this code. (Should not be done daily because of cost impacts.)

2. Monitor partition status in imagery data base and purge as required with CAMS consent.

   A segment load matrix will be developed by ISRRS to monitor the acquisition load of the 152 segment in the drought area. A weekly accounting will be made on the segments from the composition and indexing (C&I) query fiche.

   A copy of the segment load matrix will be forwarded to CAMS with potential overloads noted. At CAMS direction, ISRRS will delete from the C&I data base selected acquisitions.

3. Provide handling of full frame imagery in the ISRRS/LPDL. LPDL will be responsible for establishing a fill and for maintaining an index of the drought analyst's full frame data. These data will be secured so that only approved personnel may check out the imagery. Additionally, checkout records will be kept.

3.3 CAMS SUPPORT FOR DROUGHT ANALYSIS

3.3.1 PURPOSE

The purpose of the CAMS Operational Drought Plan is:

1. To detect when possible the effect of the drought in individual LACIE segments and to monitor any changes in the segment during the drought analysis period.

2. To determine the amount of drought effects on an individual segment by providing updated acreage estimates using CAMS standard operational procedures.

3. To work with the Drought Episodal Monitoring Team in delineating the extent of the drought using full frame imagery.

4. To assist in drawing conclusions on the effects of the drought damage.

5. To maintain a current accounting of all segments within the drought region.

3.3.2 DETAILED APPROACH

Tracking of full frame Landsat imagery will be utilized to gain an overview of large areas and study relationships between segments, in addition to determining the degree of representation of the 5 x 6 segment images. Most boundary delineations and revisions are to be extracted from these images acquired every 9 days.

PFC imagery will be monitored using standard LACIE Phase II operational procedures with the excption that drought zone packets will receive 9-day Landsat 1 and 2 coverage. Individual drought segments will be analyzed by the analyst interpreter/data processing analyst (AI/DPA) teams already assigned to those areas. These 5 x 6 mile segment analyses should provide the best opportunity to detect trends in ground conditions.

Optimally, each 5 x 6 segment would be reviewed every 9 days for any significant change from the previous acquisition data. Significant change, as it is defined both here and operationally, is a change of more than 500 pixels (system "noise" threshold) from a previous estimate, or about 2 percent of total pixels within the scene. In each case where significant change is detected on a Landsat 1 image, it will be worked for a new acreage estimate as well as the following Landsat 2 acquisition. This is to assure a complete Landsat 2 data base.

Multitemporal interpretation utilizing both Landsat 1 and 2 imagery will be performed as required for all analyst functions with the exception of machine processing. Multitemporal machine processing will be restricted to Landsat 2.

Analysis of each segment will be carried out when each new acquisition so indicates. If a segment is in work and new imagery is acquired, this new

data will be used if the analysis effort has not proceeded past the Laboratory For Remote Sensing (LARS) terminal activity. If analysis has proceeded past this point, the new data will be held and examined for significant change after the previous work has been reviewed and transmitted to CAS.

All segments previously passed to CAS as nonag, zero wheat, or less than 50 percent of the expected proportion will be reviewed on full frame imagery to determine if they are representative of the counties to which they have been allocated. When a segment is determined to be nonrepresentative, this information will be passed to CAS.

3.3.3 SUBSYSTEM INTERFACES

CAMS plans to interface with CAS through routines established for Phase II operational segments with the anticipated adjustments required by the increased load from 9-day acquisitions. Full frame imagery acquired at the same rate will require cooperation between CAMS and LPDL to assure a smooth flow of data to the analysts. Delivery from the LPDL should be made on a daily basis. The supplying of information or guidance concerning image interpretation results or available information accumulated in the interpretation processes to groups such as the Drought Episodal Monitoring Team or to YES will be provided as requested.

CAMS data sheets to CAS will be annotated as to whether the data was derived from Landsat 1 or 2 by placing an L1 or L2 in the upper right hand corner. CAMS will continue to provide analysts' comments on these sheets with emphasis on the effects of the drought on the segment. CAMS and ISRRS (LPDL) will establish a method whereby new imagery will be transmitted to CAMS even though a segment packet is "in work" in CAMS.

3.4 YES SUPPORT FOR DROUGHT ANALYSIS

3.4.1 CRITERIA

LACIE agronomist and meteorologist will establish the criteria for defining drought and nondrought areas by March 10.

3.4.2 GENERAL WEATHER ADVISORY SUPPORT

YES will continue to provide weather advisory support on a weekly basis for all LACIE activities. However, special emphasis will be given to any episodal events, and specifically for the drought area in the U.S. The following will be performed:

1. Establish rainfall amounts which would produce near normal wheat yields in the currently dry winter wheat areas if received in time.
2. Determine rainfall shortages in these areas to date.
3. Compute probability of receiving:
   a. "Required" 1976 precipitation remainder of season to heading.
   b. Normal precipitation remainder of season to heading.
   c. Modal precipitation remainder of season to heading.
   d. 10th percentile precipitation remainder of season to heading.
   e. 90th percentile precipitation remainder of season to heading.

   Assuming not more than 1 to 2 inches of soil moisture available in the wheat root zone, these precipitation probabilities will define chances of achieving varying levels of wheat yield in 1976.

   Areas with low probabilities will be mapped as subject to continuing drought.

   As the National Oceanic and Atmospheric Administration's (NOAA) Ag Met Office in the United Stated Department of Agriculture (USDA) South Building receives detailed weekly precipitation reports by CRD beginning in early March and computes initial Crop Moisture Index maps by early April, these analyses will be used to further assess risk of serious damage to the wheat crop. Occurrence or non-occurence of timely and adequate rains will be monitored and appropriate changes in drought area will be noted.

3.4.3 YIELD PREDICTIONS

The Center For Climatic and Environmental Assessment (CCEA) regression models are not tuned to be highly responsive to episodal events such as the current drought. However, some additional steps can be taken using these models to provide support to the yardstick region drought test.

1. First, standard products will be provided for the CRD's included in the drought area and those CRD's adjacent to the drought area.

2. In addition, the following will be provided for these CRD's:

   a. Using the proper truncation, weather to date plus a 30-day forecast will be inserted into the models and operated April 1, May 1, and June 1. If significant change (>25%) occurs in the forecast, runs will be made mid-period.

   b. Using end of season truncation, the models will be operated based on weather to date of run plus normal precipitation to end of season; 10th percentile of precipitation to end of season; 90th percentile precipitation to end of season. Data input dates on April 1, May 1, and June 1.

   c. The drought provides an excellent opportunity to test the applicability of alternate approaches which may provide increased sensitivity of yield to the drought conditions. These tests will include:

      (1) High spatial and temporal density precipitation data using all information, including meteorological satellite data will be applied. This will incorporate some survey of Landsat data to determine if rainfall may have occurred in areas where it was not otherwise detected.

      (2) The Feyerherm multiplication model using weather related variables will be applied to selected sample segments in Kansas. Work on weather related variables will be completed for this area by April 1. Prediction will be made prior to harvest.

      (3) The Kanamasu model, using Landsat to measure evapotranspiration will be used as a measure of stress and will be related to

yield by an empirical approach. The Landsat data that Kansas State University (KSU) needs to accomplish this is available in the statistics generated by CAMS. Stress determination will be made as data from CAMS is made available. Prediction of this stress on yield will be made prior to harvest.

3.5 CAS SUPPORT FOR DROUGHT ANALYSIS

3.5.1 AGGREGATIONS

Aggregations will be done for the Great Plains area on a monthly basis (as documented in memorandum form to information evaluation (IE).

1. Aggregations for the drought area are a subset of the total Great Plains aggregation run. Estimates specifically for the defined drought area must be hand summarized from the computer output unless a total state is included in the drought area.

2. Multiple data bases must be created and maintained.

   a. It is desirable to have two separate CAMS data bases: (1) one for Landsat 2 data only, and (2) one for all CAMS data (Landsat 1 plus Landsat 2). As a minimum, this procedure provides a count of additional segment data acquired via Landsat 1; in addition, comparison of aggregations using the two data bases provides a gross assessment of the impact of additional segment data on the estimates obtained.

   b. CAS is scheduled to receive five different yield estimates on the fourth working day of each month:

      (1) Yield estimates normally delivered generated by the operational yield models.

      (2) Yield estimates based on weather variables through the latest calendar month and a 30-day forecast of weather variables included in the yield models.

      (3) Yield estimates based on weather variables through the latest calendar month and "10th percentile rainfall" until the end of the season.

(4) Yield estimates similar to (3) except assuming "90th percentile rainfall" for the remainder of the season.

(5) Yield estimates similar to (3) and (4) except assuming "50th percentile rainfall" for the remainder of the season.

In order to have the desired level of analytical capabilities, it will be necessary to create and maintain five separate yield files.

Updates of yield estimates described in items (2) through (4) will be furnished by YES on the 15th of each month if there is a significant change in the value used in the predictor, where significant change is defined as ±25 percent.

3.5.2 EXPECTED CAS AGGREGATIONS AND RELATED DATA BASES

Table II defines the total set of aggregation capabilities resident in CAS to support regularly scheduled CAS monthly reports (CMR's) and drought-specific CAS unscheduled reports (CUR's). The reporting schedule is shown in table III.

1. Regularly scheduled CMR's will present area, yield, and production estimates generated using Landsat 2 data and yield estimates that are normally delivered (based on regression equations using weather variables through the most recent calendar month).

2. It is anticipated that CUR's will be submitted at approximate midpoints between the scheduled CMR's, if required. Such a reporting schedule will allow the incorporation of revised yield estimates from the drought-specific yield estimators if weather conditions so dictate.

   a. Additional analyses, e.g., to determine whether or not estimates are significantly different when different sets of input data are used, may require statistical support from Accuracy Assessment, the Project Scientist, or other sources selected by AES.

   b. If area, yield, and production estimates do not change significantly, CAS will recommend that results be generated internally (for use in statusing activities and to support the final drought report) and not be submitted as a CUR.

TABLE II. — EXPECTED CAS AGGREGATIONS AND RELATED DATA BASES

DESCRIPTION OF YIELD ESTIMATE	CAMS DATA	
	LANDSAT 2	LANDSAT 1 AND 2
Normal yield Delivered	CMR	D and L1 vs. L2
Yield Assuming 30-Day Forecast	D	D
10th Percentile Rainfall	D	D
50th Percentile Rainfall	D	D
90th Percentile Rainfall	D	D

CMR -- Results from aggregation submitted to IE for evaluation.

D -- Results for use in analyzing impact of drought with various combinations of drought-specific yield estimates and Landsat data acquisitions.

L1 vs. L2 -- Aggregation compared to CMR aggregation is an indicator of impact of additional quantity of Landsat data on estimates; minimum output -- Δ's in number of segments due to Landsat 1; ignores any improvement in classification attributable to availability of Landsat 1 data.

TABLE III. – CAS REPORTING SCHEDULE TO SUPPORT DROUGHT PLAN

MONTH	TARGET DATE FOR MAILING REPORT	
	CAS MONTHLY REPORT [1]	CAS UNSCHEDULED REPORT
March	None scheduled	March 24, 1976*
April	April 8, 1976	April 22, 1976*
May	May 7, 1976	May 21, 1976*
June	June 8, 1976	None anticipated [2]

[1]Dates shown here are identical to those established in correspondence with IE and falling within the guidelines stated in the CASE/IE interface control document (ICD).

[2]Expect final drought report in this time frame. In addition, the next CMR must be mailed by 6/28/76 which results in less than three weeks between reports.

*If required.

3.6 EPISODAL TEAM SUPPORT FOR DROUGHT ANALYSIS

The episodal team will work with experienced AI's with meteorological backgrounds to determine the areal extent of the drought from full frame color IR transparencies. The areal extent will be evaluated every 9 days by using meteorological overlays to locate microclimatic changes. Precipitation contours will be delineated and compared with World Meteorological Organization (WMO) station reporting. The comparisons will be provided to YES, CAMS, and CAS on a weekly basis. YES will use the data if the techniques prove to be feasible.

This monitoring effort will require meteorological AI's for four man-days per week. One AI coordinator will be utilized for one man-day per week for coordination between CAMS, CAS, YES and this effort.

The episodal team will provide the status of the drought study at the weekly LACIE Status Meeting and will be responsible for producing the final report on the drought study.